Mountaintop Software for the Dark Energy Camera

Jon Thaler[1], T. Abbott[2], I. Karliner[1], T. Qian[1], K. Honscheid[3], W. Merritt[4], L. Buckley-Geer[4]
[1]University of Illinois (UIUC), [2]CTIO, Chile, [3]Ohio State University, [4]Fermilab.

Dark Energy Survey

The Dark Energy Camera, being built for the Blanco 4-m telescope at CTIO, will be a community facility as well as a component of the Dark Energy Survey (DES). DECam mountaintop software must satisfy the needs of both communities.

Philosophy

- Useable by non-expert observers: Operation, diagnostics, debugging
- Graphical and textual interface.
- Protection against operator error.
- Manual and automated operation.
- Remote observation similar to local.
- Collaboration with CTIO, to maximize usability and support.
- Flexible enough to adapt to community needs.

Architecture

- Camera components are autonomous modules.
- Uniform interfaces and standard protocols.
- State machine functionality to ensure predictable behavior.
- Front end control developed by NOAO, adapted to DECam.
- Messaging and GUI adapted from SOAR.
- Guiding and focusing with focal plane CCDs.

Community Use

A "DECam Community Needs" document exists in draft form.
http://www.noao.edu/dir/usercom/2006/DECam-Community-Use-v2.pdf

- Visual and statistical feedback to the observer.
- Observer can probe data more deeply.
- An established set of supported observing protocols.
- Data reduction and calibration tools.
- Observer configurable operations (filters, *etc.*)
- "Expert level" tools (restricted access)
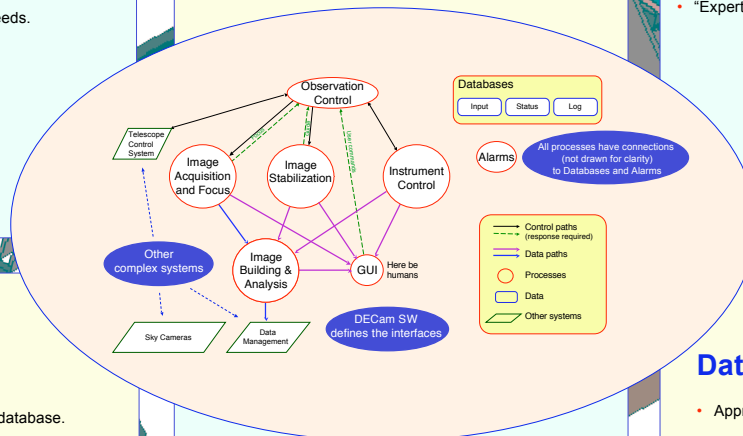
Telescope/Camera

- Command and status messages.
- Telescope status stored in the DECam database.
- Guide correction ("error" signals) at approximately 1 Hz.
- DECam focus will be adjusted by moving the camera.

Quality Assurance

- Real time image analysis.
- A simple analysis of every image.
- A more detailed analysis of a subset of images.
- For DES, QA will include simplified versions of the Data Management pipeline software.
- Other observing protocols may require different QA.

Alarms

- Safety related alarms handled by dedicated hardware.
- Software handles lower priority alerts.
- Observer receives all alerts and alarms (in human format).
- Minimize hardware alarms by monitoring trends (*e.g.*, temperatures).
- Every command requires a response. Failure to respond will generate an alert.

Data Format

- Approximately 2 GB per image.
- FITS multi-extension format.
- One FITS extension per CCD (62).
- Sufficient metadata to allow stand-alone processing.

Databases

- Input: Calibration constants, operating sequences, *etc.*
- Status: Which filter is in, shutter open/closed, etc.
- Log: (All data accessible as time series)
  ° Every command and message sent on the network.
  ° Observers' commentary.
  ° Instrument, environment, and sky monitor data.
  ° Results of "quick look" calculations.